

App. No. 10/825,267
Office Action dated August 16, 2006

Amendments to the Claims:

This listing of claims will replace all prior versions and listing of claims in the application.

Claims 1, 22 and 23 are amended.

Listing of Claims:

1. (Currently amended) A linear moving mechanism comprising:
a guide member providing a horizontal straight transport path;
a moving member movable along the transport path; and
a drive mechanism which drives the moving member,
wherein the drive mechanism includes a first link arm pivotable around a first vertical shaft, and a second link arm having a first end and a second end, the first vertical shaft being on the transport path or on a line parallel to the transport path, the first end being connected to the first link arm for pivotal movement of the second link arm in a horizontal plane, the second end being connected to the moving member for pivotal movement of the second link arm in a horizontal plane; and
wherein the guide member includes a plurality of guide rails extending in parallel to the transport path and spaced from each other horizontally, the moving member extending across the transport path to bridge between the guide rails.
2. (Original) The linear moving mechanism according to Claim 1, wherein the pivotal movement of the first link arm around the first vertical shaft moves a connecting point connecting the second link arm and the moving member along a path identical with the transport path, identical with a line parallel to the transport path or identical with an arc extending generally along the transport path.

App. No. 10/825,267
Office Action dated August 16, 2006

3. (Original) The linear moving mechanism according to Claim 1, wherein the drive mechanism further includes: an assisting link arm pivotable around a second vertical shaft which is different from the first vertical shaft; and a middle link to which the first link arm and the assisting link arm are connected for pivotal movement around a third vertical shaft and a fourth vertical shaft respectively; whereby the first link arm, the assisting link arm and the middle arm provide a parallelogram link mechanism,

the second link arm being connected pivotably to the middle link around a fifth vertical shaft provided on a line passing the third vertical shaft and the fourth vertical shaft, the second link arm being connected pivotably to the moving member around a sixth vertical shaft,

a center-to-center distance between the fifth vertical shaft and the sixth vertical shaft being equal to a center-to-center distance between the first vertical shaft and the third vertical shaft.

4. (Previously presented) The linear moving mechanism according to Claim 3, wherein the guide member is provided with a guide groove extending in a direction across the transport path, the sixth vertical shaft being fitted in the guide groove.

5. (Original) The linear moving mechanism according to Claim 3, further comprising an assisting moving member supported by the moving member and movable along the transport path, wherein the second link arm is connected pivotably to the assisting moving member around a seventh vertical shaft provided on a line passing the fifth vertical shaft and the sixth vertical shaft, the second link arm being connected to the assisting moving member for movement of the seventh vertical shaft in a direction across the transport path, the pivotal movement of the first link arm around the first vertical shaft moving the seventh vertical shaft along an arc extending generally along the transport path.

6. (Original) The linear moving mechanism according to Claim 3, further comprising an assisting moving member supported by the moving member and movable along the transport path, wherein the parallelogram link mechanism includes an assisting middle link provided on a more outward side than is the middle link, and connected pivotably to the first link arm and to the assisting link arm around an eighth vertical shaft and a ninth vertical shaft, the assisting

App. No. 10/825,267

Office Action dated August 16, 2006

middle link connecting to a third link arm, the third link arm being pivotable around a tenth vertical shaft provided on a line passing the eighth vertical shaft and the ninth vertical shaft, the third link arm being connected pivotably to the assisting moving member around an eleventh vertical shaft, a center-to-center distance between the tenth vertical shaft and the eleventh vertical shaft being equal to the center-to-center distance between the first vertical shaft and the eighth vertical shaft.

7. (Previously presented) The linear moving mechanism according to Claim 1, wherein the drive mechanism further includes: an assisting link arm pivotable around a second vertical shaft which is different from the first vertical shaft, and a middle link to which the first link arm and the assisting link arm are connected for pivotal movement around a third vertical shaft and a fourth vertical shaft respectively; whereby the first link arm, the assisting link arm and the middle arm provide a parallelogram link mechanism,

the second link arm being connected pivotably to the middle link around a fifth vertical shaft provided on a line passing the third vertical shaft and the fourth vertical shaft, the second link arm being connected pivotably to the moving member around a sixth vertical shaft, the second link arm being connected pivotably to the moving member around a sixth vertical shaft, the sixth vertical shaft being fitted in a guide groove formed on the guide member, the guide groove extending in a direction across the transport path,

a center-to-center distance between the fifth vertical shaft and the sixth vertical shaft being longer than the center-to-center distance between the first vertical shaft and the third vertical shaft.

8. (Original) The linear moving mechanism according to Claim 7, wherein the first link arm has a first gear fixed in alignment with the third vertical shaft, the second link arm having a second gear fixed in alignment with the fifth vertical shaft, the first gear and the second gear having an identical diameter and engaging with each other.

9. (Original) The linear moving mechanism according to Claim 3, wherein the first link arm has a first intermittent gear fixed in alignment with the third vertical shaft, the second link arm

App. No. 10/825,267
Office Action dated August 16, 2006

having a second intermittent gear fixed in alignment with the fifth vertical shaft, the first intermittent gear and the second intermittent gear making temporary engagement with each other.

10. (Original) The linear moving mechanism according to Claim 6, wherein the first link arm has a first gear and a third gear fixed in alignment with the third vertical shaft and the eighth vertical shaft respectively, the second link arm having a second gear fixed in alignment with the fifth vertical shaft, the first gear and the second gear having an identical diameter and engaging with each other, the third link arm having a fourth gear fixed in alignment with the tenth vertical shaft, the third gear and the fourth gear having an identical diameter and engaging with each other.

11. (Original) The linear moving mechanism according to Claim 6, wherein the first link arm has a first intermittent gear and a third intermittent gear fixed in alignment with the third vertical shaft and the eighth vertical shaft respectively, the second link arm having a second intermittent gear fixed in alignment with the fifth vertical shaft, the first intermittent gear and the second intermittent gear making temporary engagement with each other, the third link arm having a fourth intermittent gear fixed in alignment with the tenth vertical shaft, the third intermittent gear and the fourth intermittent gear making temporary engagement with each other.

12. (Original) A transfer robot comprising:
a linear moving mechanism for moving a work along a horizontal straight transport path;
and
a fixed base supporting the linear moving mechanism,
wherein the linear moving mechanism includes: a guide member providing a horizontal straight transport path; a moving member movable along the transport path; and a drive mechanism which drives the moving member, the drive mechanism including a first link arm pivotable around a first vertical shaft, and a second link arm having a first end and a second end, the first vertical shaft being on the transport path or on a line parallel to the transport path, the first end being connected to the first link arm for pivotal movement of the second link arm in a

App. No. 10/825,267
Office Action dated August 16, 2006

horizontal plane, the second end being connected to the moving member for pivotal movement of the second link arm in a horizontal plane, and

wherein the linear moving mechanism supported by the fixed base allows the guide member to swivel around a vertical swivel shaft on the transport path, the moving member having a prong on which the work is to be placed.

13. (Original) The transfer robot according to Claim 12, wherein the linear moving mechanism supported by the fixed base is capable of rising and lowering along the swivel shaft.

14. (Original) The transfer robot according to Claim 12, wherein the linear moving mechanism is on a swivel base rotatable around the swivel shaft with respect to the fixed base, the moving member including a first moving member and a second moving member supported by the guide member movably along the transport path without interfering with each other, the drive mechanism including a first drive mechanism and a second drive mechanism provided in the swivel base for driving the first moving member and the second moving member respectively.

15. (Original) The transfer robot according to Claim 14, wherein the first drive mechanism and the second drive mechanism are symmetric with each other with respect to the transport path.

16. (Original) The transfer robot according to Claim 14, wherein the guide member is provided with a pair of first guide rails and a pair of second guide rails, the first guide rails movably supporting the first moving member and sandwiching the transport path, the second guide rails movably supporting the second moving member and sandwiching the transport path from outside the first guide rails.

17. (Original) The transfer robot according to Claim 16, wherein each of the first moving member and the second moving member has a prong support supporting a plurality of prongs, the prong support of the second moving member being above the prong support of the first moving member, the second moving member being supported by the second guide rails via a pair

App. No. 10/825,267
Office Action dated August 16, 2006

of supporting arms extending from two sides of the prong support of the second moving member to detour two sides of the prong support of the first moving member.

18. (Original) The transfer robot according to Claim 17, wherein the first moving member includes a connecting arm inward of the second guide rails and extending through the guide member, and is connected to the second link arm of the first drive mechanism via the connecting arm, the second moving member being connected to the second link arm of the second drive mechanism in an appropriate region of the supporting arms.

19. (Original) The transfer robot according to Claim 16, further comprising an assisting moving member supported by the second moving member, wherein each of the first moving member and the assisting moving member has a prong support supporting a plurality of prongs, the prong support of the assisting moving member being above the prong support of the first moving member, the second moving member being supported by the second guide rails via a pair of supporting arms extending from two sides of the prong support of the second moving member to detour two sides of the prong support of the first moving member.

20. (Original) The transfer robot according to Claim 19, wherein the first moving member includes a connecting arm inward of the second guide rails and extending through the guide member, and is connected to the second link arm of the first drive mechanism via the connecting arm, the second moving member being connected to the second link arm of the second drive mechanism in an appropriate region of the supporting arms, the assisting moving member being connected to the second link arm of the second drive mechanism via a longitudinal guide groove extending in a direction across the transport path.

21. (Previously presented) A linear moving mechanism comprising:
a guide member providing a horizontal straight transport path;
a moving member movable along the transport path; and
a drive mechanism which drives the moving member,

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App. No. 10/825,267
Office Action dated August 16, 2006

wherein the drive mechanism includes a first link arm pivotable around a first vertical shaft, and a second link arm having a first end and a second end, the first vertical shaft being on the transport path or on a line parallel to the transport path, the first end being connected to the first link arm for pivotal movement of the second link arm in a horizontal plane, the second end being connected to the moving member via a vertical shaft for pivotal movement of the second link arm in a horizontal plane; and

wherein the guide member is provided with a guide groove extending in a direction across the transport path, the vertical shaft being fitted in the guide groove.

22. (Currently amended) A linear moving mechanism comprising:
a guide member providing a horizontal straight transport path;
a moving member movable along the transport path; and
a drive mechanism which drives the moving member,

wherein the drive mechanism includes a first link arm pivotable around a first vertical shaft, and a second link arm having a first end and a second end, the first vertical shaft being on the transport path or on a line parallel to the transport path, the first end being connected to the first link arm for pivotal movement of the second link arm in a horizontal plane, the second end being connected to the moving member for pivotal movement of the second link arm in a horizontal plane;

~~wherein the guide member includes a plurality of guide rails extending in parallel to the transport path, the moving member extending across the transport path to bridge between the guide rails;~~

wherein the drive mechanism further includes: an assisting link arm pivotable around a second vertical shaft which is different from the first vertical shaft; and a middle link to which the first link arm and the assisting link arm are connected for pivotal movement around a third vertical shaft and a fourth vertical shaft respectively; whereby the first link arm, the assisting link arm and the middle arm provide a parallelogram link mechanism,

the second link arm being connected pivotably to the middle link around a fifth vertical shaft provided on a line passing the third vertical shaft and the fourth vertical shaft, the second link arm being connected pivotably to the moving member around a sixth vertical shaft,

App. No. 10/825,267
Office Action dated August 16, 2006

a center-to-center distance between the fifth vertical shaft and the sixth vertical shaft being equal to a center-to-center distance between the first vertical shaft and the third vertical shaft; and

wherein the linear moving mechanism further comprises an assisting moving member supported by the moving member and movable along the transport path, the second link arm being connected pivotably to the assisting moving member around a seventh vertical shaft provided on a line passing the fifth vertical shaft and the sixth vertical shaft, the second link arm being connected to the assisting moving member for movement of the seventh vertical shaft in a direction across the transport path, the pivotal movement of the first link arm around the first vertical shaft moving the seventh vertical shaft along an arc extending generally along the transport path.

23. (Currently amended) A linear moving mechanism comprising:

a guide member providing a horizontal straight transport path;

a moving member movable along the transport path; and

a drive mechanism which drives the moving member,

wherein the drive mechanism includes a first link arm pivotable around a first vertical shaft, and a second link arm having a first end and a second end, the first vertical shaft being on the transport path or on a line parallel to the transport path, the first end being connected to the first link arm for pivotal movement of the second link arm in a horizontal plane, the second end being connected to the moving member for pivotal movement of the second link arm in a horizontal plane;

~~wherein the guide member includes a plurality of guide rails extending in parallel to the transport path, the moving member extending across the transport path to bridge between the guide rails;~~

wherein the drive mechanism further includes: an assisting link arm pivotable around a second vertical shaft which is different from the first vertical shaft; and a middle link to which the first link arm and the assisting link arm are connected for pivotal movement around a third vertical shaft and a fourth vertical shaft respectively; whereby the first link arm, the assisting link arm and the middle arm provide a parallelogram link mechanism,

App. No. 10/825,267
Office Action dated August 16, 2006

the second link arm being connected pivotably to the middle link around a fifth vertical shaft provided on a line passing the third vertical shaft and the fourth vertical shaft, the second link arm being connected pivotably to the moving member around a sixth vertical shaft, a center-to-center distance between the fifth vertical shaft and the sixth vertical shaft being equal to a center-to-center distance between the first vertical shaft and the third vertical shaft; and

wherein the linear moving mechanism further comprises an assisting moving member supported by the moving member and movable along the transport path, the parallelogram link mechanism including an assisting middle link provided on a more outward side than is the middle link, and connected pivotably to the first link arm and to the assisting link arm around an eighth vertical shaft and a ninth vertical shaft, the assisting middle link connecting to a third link arm, the third link arm being pivotable around a tenth vertical shaft provided on a line passing the eighth vertical shaft and the ninth vertical shaft, the third link arm being connected pivotably to the assisting moving member around an eleventh vertical shaft, a center-to-center distance between the tenth vertical shaft and the eleventh vertical shaft being equal to the center-to-center distance between the first vertical shaft and the eighth vertical shaft.

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